

What is claimed is:

1. A compact and highly portable oxygen delivery apparatus for medical uses by producing from ambient air under pressure a product gas having a high concentration of oxygen and delivering the product gas to a user of the apparatus, the apparatus weighing less than about ten pounds with an overall physical volume less than about 820 cubic inches and comprising a pressure swing adsorption system having at least two nitrogen adsorber beds and integrated conserving means including means for sensing inhalation by the user for delivering the product gas only during initial inhalation of the user at selectable rates up to at least about 26 ml or the physiological equivalent of about 3 LPM of continuous delivery of product gas.

2. The apparatus according to claim 1, in which the physical dimensions of the apparatus are less than about 17" in one dimension, less than about 8" in a second dimension and less than about 6" in the third dimension.

3. The apparatus according to claim 3, in which the adsorber beds each are about 9.75 inches in length and about 1.25 inches in diameter.

4. The apparatus according to claim 1, and comprising means for producing the product gas at a pressure of between about 19 psia and about 23 psia and a concentration of oxygen in the product gas of between about 80% and about 95%.

5. The apparatus according to claim 4, and further comprising an alarm that is activated if the oxygen concentration falls below about 80%.

6. The apparatus according to claim 1, and further comprising means for powering the pressure swing adsorption system selectively by either a detachable battery, a connection to an AC power source and/or a connection to an external battery source.

7. The apparatus according to claim 1, and further comprising access means for selecting the delivery rate and for activating the pressure swing adsorption system, and cover means for enclosing the access means.

8. The apparatus according to claim 1, and further comprising programmed means for delivering product gas to the user at a regulated pressure for predetermined selectable times upon sensing inhalation.

9. The apparatus according to claim 1 in which the conserving means delivers the product gas at selectable rates up to at least about 44 ml or the physiological equivalent of about 5 LPM of continuous delivery of product gas.

10. The apparatus according to claim 9, and comprising means for producing the product gas at a pressure of between about 19 psia and about 23 psia and a concentration of oxygen in the product gas of between about 80% and about 95%.

11. The apparatus according to claim 10, and further comprising an alarm that is activated if the oxygen concentration fall below about 80%.

12. The apparatus according to claim 9, and further comprising means for powering the pressure swing adsorption system selectively by either a detachable battery, a connection to an AC power source and/or a connection to an external battery source.

13. The apparatus according to claim 9, and further comprising access means for selecting the delivery rate and for activating the pressure swing adsorption system, and cover means for enclosing the access means.

14. The apparatus according to claim 9, and further comprising programmed means for delivering product gas to the user at a regulated pressure for predetermined selectable times upon sensing inhalation.

15. In an oxygen concentrator intended to supply supplemental oxygen to a user by an oxygen concentrated product gas, the concentrator including a pressure swing adsorption system operated under pressure by a power source and oxygen conservation means for delivering the product gas to the user during an initial period of inhalation by the user, the improvement comprising control means having a transducer to sense inhalation, means for enabling flow of the product gas to the user in

a predetermined amount, means for selecting the predetermined amount from a range of settings, and circuit means responsive to the transducer for actuating the enabling means for a predetermined time period based on the setting, the circuit means responsive to variations in the pressure, power source and the user's breathing rate determined from continuous or sampled readings of the setting, system pressure, power source, and breathing rate within predetermined parameters predicting the concentration of oxygen in the product gas being delivered.

16. The improvement according to Claim 15 and further comprising means for signaling the user if the oxygen concentration falls below a predetermined level.

17. The improvement according to Claim 15 and further comprising means for signaling the user if the system pressure is above or below a predetermined level.

18. The improvement according to Claim 15 and further comprising means for generating a signal if inhalation is not sensed within a predetermined time.

19. The improvement according to Claim 15, in which the circuit means further comprises means for testing the operating components of the concentrator by cycling the pressure swing adsorption system through at least certain of its operating modes.

20. The improvement according to Claim 15, in which the circuit means further comprises a temperature switch to shut off the power source in the event of overheating of the pressure swing adsorption system.

21. The improvement according to Claim 15, in which the circuit means further comprises a micro-controller with a crystal oscillator receiving input data from an analog pressure conditioning circuit, a power source management system, the actuating means, the setting means and means for sensing the system pressure.

22. The improvement according to Claim 15, in which the circuit means further comprises a power source reset circuit for minimizing current drawn from the power source by disabling a portion of the circuit means.

23. The improvement according to Claim 15, in which the circuit means further comprises means for determining an average system pressure from a predetermined number of actual system pressures sensed in immediately preceding breaths taken by the user.

24. The improvement according to Claim 15, in which the power source comprises both a battery and access to an external power source, and the circuit means further comprises a battery management system to control supply voltage to the battery when connected to an external power source.

25. The improvement according to Claim 15, in which setting means includes about five predetermined settings, and the circuit means operates to actuate the enabling means for time periods that will deliver the product gas to the user to approximate the physiological equivalent of about five integer amounts of about one to about five liters per minute.

26. The improvement according to Claim 15, in which the circuit means further comprises first, second and third indicators, in which the first indicator indicates system start-up and user breathing rate, the second indicator indicates condition of the power source, and the third indicator indicates to the user a system failure, low pressure, and/or a failure to sense inhalation within a predetermined time.

27. The improvement according to Claim 15, in which the circuit means further comprises a resettable meter to measure accumulated operating time of the pressure swing adsorption system.

28. The improvement according to Claim 15, in which the circuit means further comprises means attached to the user for measuring the blood oxygen level of the user and for adjusting the setting means in response to the blood oxygen level.